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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A118939	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Medical Operations in Nuclear War		5. TYPE OF REPORT & PERIOD COVERED Student Essay
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Richard T. Travis, M.D. Colonel, Medical Corps		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army War College Carlisle Barracks, PA 17013		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Same		12. REPORT DATE 15 April 1982
		13. NUMBER OF PAGES 38
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A survey of medical effects of nuclear weapons and possible means for limiting these effects. A quick look at the role and capabilities of medical organizations to cope with mass casualties.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

US ARMY WAR COLLEGE

INDIVIDUAL RESEARCH BASED ESSAY

MEDICAL OPERATIONS IN NUCLEAR WAR

BY

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15 APRIL 1982

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CHAPTER 1

INTRODUCTION

The overriding objective of US military posture is deterrence of attack on the United States or its allies. The US doctrine of flexible response and policy of limited nuclear options are attempts to enhance this deterrent. To be effective as a deterrent, the Army must be able to project a believable defense against the full range of enemy military capabilities--conventional, chemical and nuclear. As a physician/soldier I must contribute to this credible deterrence through knowledge about nuclear warfare. For almost eighteen years, I have been remiss in carrying out those responsibilities. Though perhaps deplorable in this nuclear age and in the era of the Air-Land Battle I submit that my position is by no means unique. Human nature dictates that the violence and destruction attendant to nuclear warfare is of such magnitude that we do not care to think about it much less plan for it. Few citizens realize that US national security policy does not preclude the first use of nuclear weapons by US forces.[1] The Army Medical Department must prepare for nuclear war.

During the periods of extensive nuclear weapons testing, military physicians were involved and learned firsthand about their effects. As the testing diminished medical familiarity with biomedical effects also began to disappear at the clinical (treating) physician level. I

believe this to be a significant problem since most physicians are unaware of the unusual medical situations that may be encountered during a nuclear war.

There has been no use of nuclear weapons since the explosion of bombs on Hiroshima and Nagasaki in 1945. Those bombs, equivalent to the detonation of a 20 KT mid to high air burst, produced an estimated 225,000 casualties and 125,000 deaths.[2] The magnitude of the long term consequences have been compared to genocide and the "complete negation of human existence."[3] Despite the holocaust, the potential for nuclear warfare is much greater today. Five nations now possess nuclear weapons and delivery systems. Most people are now beginning to believe (as stressed by Herman Kahn over fifteen years ago) that however slight or serious the nuclear exchange, we as a race will survive.

Four themes dominate Soviet military literature and constitute the underpinnings of their approach to theater nuclear weapons.

(1) The revolutionary nature of the changes brought about by mass introduction of nuclear weapons.

(2) The overriding importance of surprise and striking first.

(3) The destructive nature of the battlefield environment.

(4) The perceived underlying NATO threat.[4]

The manner of our survival, let alone our tactical mission accomplishment will depend in large measure on the success of our preparation, and a prime factor in that success is the preparation of our medical system and personnel to accept and treat the casualties of nuclear war.

Research Objectives

The basic objectives of this research was to further my personal and

professional education in the remarkable array of important subjects dealing with the employment of nuclear devices in the conduct of high intensity war.

Secondary objectives were the elucidation of medical problems associated with conducting medical operations in a nuclear environment as well as providing discussion of possible solutions to the problems.

A tertiary objective was developed during the research phase of the project. I have attempted to consolidate in a single source the information and reference material required of the physician/soldier should he be called upon to provide command guidance during the conduct of operations.

ENDNOTES

1. US Department of the Army, Field Manual 100-1, p. 21 (hereafter referred to as "FM 100-1").

2. US Strategic Bombing Survey, Effects of Atomic Bombs on Health and Medical Services in Hiroshima and Nagasaki, p. 57.

3. Herbert Mitgang, "Study of Atomic Bomb Victims Stress Long Term Damage," The New York Times, 6 August 1981, p. A-8.

4. Joseph P. Douglas, Jr., "The Soviet Theater Nuclear Offensive, p. 15.

CHAPTER 2

BASIC CONSIDERATIONS

No nation has experience in nuclear warfare. A portrayal of how the Army will respond to the occurrence of a nuclear attack is essentially an extrapolation. The data driving this discussion is therefore based on previously experienced levels of combat and our knowledge of nuclear detonation effects.

Following the detonation of a nuclear device the Division Commander and the Command Surgeon will not be interested in the azimuths that triangulated the round zero of the weapon, how the blast wave exhaled and inhaled, how the fireball missed touching the ground by 2.73 feet, how the color of the fireball was halfway between fuschia and magenta, and how the characteristic cloud formation appeared more like an asparagus than a mushroom!

The General and his surgeon will want to know what happened? Which units were hit? What is the loss estimate? How effective are the survivors and how long will they remain effective? Who is in charge? Will there be fallout? Where? Are there bridges intact? How is the road net? What has been the enemy's subsequent actions?

The physician need not burden himself with these concerns. Headquarters, Headquarters Companies of Artillery and Air Defense units are generally the most suitable organizations to collect and report nuclear

burst data. Their responsibilities are well outlined in FM 3-12.[1]

The introduction of the NBC company is a new and extremely important asset on the integrated battlefield. The divisional NBC company's mission is to locate contaminated areas quickly and to conduct decontamination operations as far forward in the combat zone as possible. Their operations are described in FM 3-87.[2]

The objectives of field medical support on the integrated battlefield will be to optimize resources in the face of mass casualties, manage patients to minimize nuclear injuries, maintain continued operation of medical facilities, avoid spread of contamination in facilities, protect medical and paramedical personnel from contaminated patients, and provide adequate medical supplies to insure continued functioning of medical services.[3]

Every effort must be made to conserve and properly utilize available medical personnel. Each physically able patient will be required to expeditiously decontaminate themselves and their equipment. Each treatment facility will require the establishment of a decontamination station convenient to its entrance.

Mass Casualties

Sears estimated that the two atomic bombs dropped on Japan created 135,000 casualties who required immediate medical attention.[4] That number of casualties certainly overwhelmed the medical care system that remained in place. However, a mass casualty situation is not created by numbers alone, but rather a disparity between workload and worker capability.

In nuclear operations that disparity will be created by any/all of the following scenarios:

(1) The medical staff decreases and patient flow remains constant.

(2) Staff to patient ratios remain constant but evacuation to the rear area is interrupted.

(3) Staff, patients and evacuation capability remain constant but the treatment facilities are destroyed.

(4) All the above elements remain constant but there is an interruption of the supply of critical materials.

We must assume that no matter the inelegant dimension of destruction some part of the medical organization will remain functional. The disaster is a medical family matter, not just a concern for the field medic or the clinician in a treatment facility. No single part of the family will solve the problem in isolation. The disparity situation will mandate orchestration of simultaneous accomplishments using whatever resources available.

The author suggests reading the NATO Handbook: Emergency War Surgery, Chapter VII as an excellent source of information dealing with the problem of mass casualties.[5]

Planning

I have hinted that successful disaster recovery will not occur spontaneously. There must be a system by which the medical organization handles the matter. Therefore, to the extent possible decisions and actions that take place during and after nuclear attack must be made in advance. Policies must be prepared, standard operating procedures outlined and plans developed and exercised that will govern who does what to whom and when they will do it. These documents will establish in advance who will be the boss, under what circumstances, what his authority and

responsibilities will embrace and what assets he'll control to accomplish the mission. Each functional individual under his control will in turn orchestrate their work forces as part of the layered concerted effort. Medical operations must remain in harmony with the tactical situation.

Physician Operations

Physician/soldiers will play one of three distinct roles in the theater of operations: practitioner, staff (Command Surgeon), Command (leader of a specific medical treatment unit). The diagnosis and treatment of injuries and disease precipitated by nuclear weapons detonation would certainly be within the knowledge of most experienced physicians. Thus, I will confine my discussion to the functions of the Command Surgeon and Medical Commander.

Command Surgeon

The Command Surgeon and his staff will advise the unit Commander on the medical aspects and implications associated with the use of nuclear munitions. He will announce clinical and operational policy governing the medical response to workloads resulting from nuclear engagements. He will estimate the volume and nature of the medical workload in order to predict the assets that must be on hand to accomplish the mission. He will prepare the medical plans that will orchestrate the employment of those assets. Lastly, he will conduct staff visits, inspections, and exercises to ensure that the plans are functional and the players ready to accomplish their mission. It makes little difference except for experience at what level the command surgeon is assigned. Both maneuver battalions and theater headquarters must accomplish these tasks to a greater or lesser degree.

The advisory role that the command surgeon will play in actual nuclear warfare presents one significant problem area: advice regarding the use of troops who have already absorbed one or more subclinical doses of ionizing radiation. There is little precise guidance the surgeon can give because there is a paucity of data on prolonged, repetitious exposure of humans at rad levels that will prevail on the battlefield. If you add together the weapon yield, tactical, geographic and climatic variables plus the imprecision of collection and recording of unit cumulative radiation exposure, the surgeon has far less chance of making an accurate prediction than the nightly weatherman.

The distinction between acute and chronic exposure is also critically important when assaying long term effects from radiation.[6] However, as a present rule of thumb, the surgeon would be well advised to suggest to the commander that any troops sustaining an accumulated exposure beyond 300 rads will ensure that they will be non-effective within a few hours or days.[7] Those who have non-strenuous jobs will function longer than those who require greater exertion, stamina and overall coordination.[8]

The nuclear battlefield can also be anticipated to precipitate large numbers of psychologic stress reactions. The primary cause of this will be the disastrous condition, the unknowns about radiation hazards and isolation of surviving individuals and units who are cut off from their leaders or adjacent and supporting units because of destruction of communications.[9]

Committing large numbers of stress reactors and soldiers previously exposed to radiation may well precipitate psychotic reactions in many individuals. Under such circumstances the matter of further radiation

versus unit effectiveness may be purely academic.

The staff surgeon should also be responsible for the training of non-medical soldiers in self/buddy aid procedures. Although such training tends to interfere with the regular duty of soldiers, the trainees must be convinced that their ability to care for themselves may be the only medical care they will receive in the minutes and hours following a nuclear attack. Training is also the key to the education of psychological effects of nuclear weapons. Training to conduct prompt effective actions will relieve tension and stresses so that fear is less likely to become severe or incapacitating.[10] Every soldier should be familiar with the contents of FM 21-41. This is a hip pocket ready reference for individual NBC defensive procedures.[11]

Commander

The functions of a medical treatment facility commander in response to high intensity conflict will not significantly change except for duty hours! He will continue the dual responsibility of being a health care system manager as well as a Commander of a military organization.

Hospital Operations

The disparity situation in a medical treatment facility during nuclear operations is merely a potential challenge until survivors are extracted from the damaged area. (Assuming the hospital isn't on the battlefield.) If patient evacuation is lengthy, time will become a triage officer. That is, the critical die before they arrive and the survivors that arrive have achieved by themselves a degree of physiologic stabilization that reduces the sense of urgency and permits a more orderly scheme of management.

The process of disaster response - subduing confusion, restoring order, finding, collecting, sorting and evacuating patients takes time. The medical workload will therefore, be distributed over time and perhaps distance depending on area damage.

Assuming that the medical organization is capable of responding in an effective manner to expedite the restoration of order while collecting and evacuating survivors, the medical treatment facility commander will have time to organize his unit and prepare for the following events:

(1) Perform the basic medical tasks inherent in battlefield casualty management.

(2) Review with his staff the Standard Operating Procedures and individual responsibilities unique to operations in a disparity situation.

(3) Participate in the overall disaster control phase so that medical response is integrated into the total military response.

(4) Establish radioactive monitoring techniques and decontamination facilities. An excèllent discussion of these subjects is found in FM 3-220.[12]

Special Considerations

Radioactive fallout will have a disruptive effect on medical operations. This will result from the immobility of the treatment facility itself as well as the patient population enclosed therein. Division 86 organization calls for two Combat Support Hospitals (120-400 beds) per division supported by one Evacuation Hospital (400 beds) further to the rear of the FLOT. These are not mobile facilities. Expeditious evacuation of patients in the early post attack phase is improbable.

The solution to this problem will require ingenuity, courage, and a thorough understanding of how the facility fits into the area fallout alert mechanism, how shielding tends to minimize the hazard and - most importantly - the use and interpretation of dosimetry devices. Working knowledge and application of the principles and instruments outlined in "FM 3-12" is essential in solving the problem.[13]

ENDNOTES

1. US Department of the Army, Field Manual 3-12, pp. 2-3-2-11 (hereafter referred to as "FM 3-12").

2. US Department of the Army, Field Manual 3-87, pp. 3-1-4-24 (hereafter referred to as "FM 3-87").

3. US Army Command and General Staff College, Reference Book 100-34, p. B-1 (hereafter referred to as "RB 100-34").

4. Thad B. Sears, The Physician in Atomic Defense, p. 143.

5. "Mass Casualties - Thermonuclear Warfare," Emergency War Surgery, pp. 62-81.

6. Samual Glasstone and Philip Dolan, The Effects of Nuclear Weapons, pp. 575-587.

7. William Alter, Effects on Ionizing Radiation on Organ Function, pp. H-1-H-10. Cited with special permission of PhD Alter.

8. J. Pyechs, et al., Post Attack Measures of Effectiveness, p. 29.

9. "RB 100-34," p. 2-12.

10. Ibid., p. 2-13.

11. US Department of the Army, Field Manual 21-41 pp. 5-6 (hereafter referred to as "FM 21-41").

12. US Department of the Army, Technical Manual 3-220, pp. 65-83 (hereafter referred to as "TM-3-220").

13. "FM 3-12" p. 4-13, pp. 6-2 - 6-9.

CHAPTER 3

BIOLOGIC EFFECTS

The radii of biologic effects from a nuclear detonation are variable. Calculation of the effect must include the size of the weapon yield; bursting position relative to ground level; distance from ground zero; presence or absence of shielding; skin exposure; type of clothing; presence of particulate matter in the air; climacteric conditions and time of the detonation.[1] DA Pamphlet 50-3 is an exhaustive, authoritative text on this subject.

A nuclear weapon detonation produces the following types of energy by percentage:[2]

(1)	Blast	50%
(2)	Thermal	35%
(3)	Residual nuclear radiation	10%
(4)	Initial nuclear radiation	4%
(5)	Electromagnetic pulse	1%

Blast carries with it the additive factor of flying debris which becomes a wound producer as well as the potential for causing man to become a missile which ultimately will strike an immovable object.

Although thermal effects begin to dominate troop safety at about 3 KT the dominant killer on the battlefield will be radiation.[3] Emmission begins immediately upon detonation and its damaging components consist

primarily of neutron and gamma radiation. Both produce casualties and the human system will follow a dose response curve as shown in Table 2-1.[4] Exposure in the 100 rad region "has little militarily significant effect."[5]

Residual nuclear radiation lasts after the first minute. It consists primarily of fallout, rainout and neutron-induced gamma activity.

Figure 2-1 graphically portrays the distances to which various effects of nuclear detonation may occur.[6]

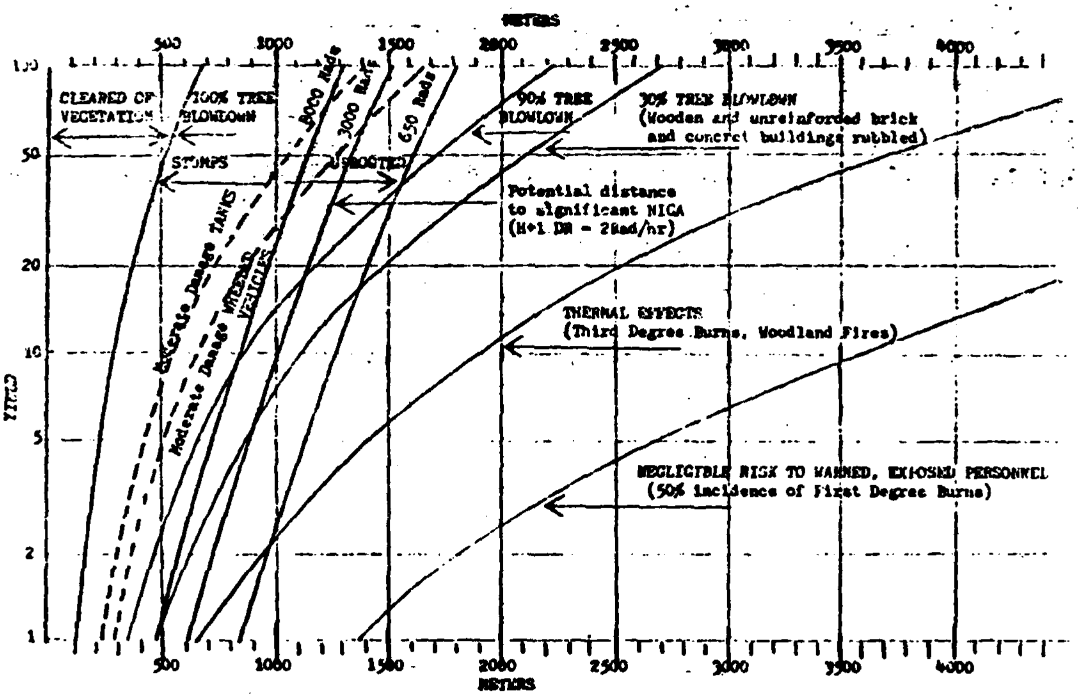
TABLE 2-1

TABLE 2-1. EXPECTED RESPONSE IN GROUPS OF PERSONNEL EXPOSED TO GAMMA AND NEUTRON RADIATION.

Dose in Rads	Early Symptoms*	Effectiveness	Fatalities
0 to 70	Less than 5% hospitalization	Full	None
150	Approximately 5% within 6 hours	Reduced effectiveness while vomiting, depending on task. Ineffective if hospitalized.	None
650	Within 2 hours 100%	Symptoms continue intermittently for next few days. Effectiveness reduced significantly for 2d to 6th day. Hospitalization required	More than half at approximately 16 days.
2,000 to 3,000	Within 5 minutes 100%	Immediate, temporary incapacitation for a period of 30-40 minutes, followed by recovery period during which personnel efficiency is impaired. No operational capability.	In approximately 7 days.
8,000	Within 5 minutes 100%	Immediately, permanent incapacitation for personnel performing physically demanding tasks. No period of latent "recovery." No operational capability.	In 1-2 days
18,000	Immediate 100%	Permanent incapacitation for personnel performing even undemanding tasks. No operational capability.	Within 24 hours

*Symptoms include vomiting, diarrhea, "dry heaving," nausea, lethargy, depression, and mental disorientation. At lower dose levels, incapacitation is a simple slowing down of the rate of performance due to a loss of physical mobility and/or mental disorientation. At the high dose levels shock and coma may be the "early symptoms."

FIGURE 2-1



1. Enter the graph at the yield of interest on the left hand margin (i.e., 20 KT yield weapon)
2. Move to the right to the effect desired (i.e., 3000 Rad dose-curve)
3. Read on the top or bottom scale the distance to which this effect extends from ground zero (i.e., 1000 meters)

ENDNOTES

1. US Department of the Army, Phamphlet 50-3, pp. 575-587 (hereafter referred to as "DA PAM 50-3").

2. "RB 100-34," p. 2-1.

3. US Department of the Army, Field Manual 100-5, p. 10-3 (hereafter referred to as "FM 100-5").

4. US Department of the Army, Field Manual 21-40, p. 1-7 (hereafter referred to as "FM 21-40").

5. "RB 100-34," p. 2-3.

6. Ibid., p. 2-6.

CHAPTER 4

CASUALTY ESTIMATION

Casualty estimation is not a physician's responsibility. It falls under the purview of the S1/G1.[1] Supervising and coordinating predictions of fallout from threat-employed nuclear weapons is an S2/G2 function.[2] Coordination with these staffs is highly recommended. It is to the treatment facility's advantage to predict the workload due to hostile action in the most differentiated, condition specific manner possible. This prediction will better indicate the resources needed to handle the workload.

ENDNOTES

1. US Department of the Army, Field Manual 101-5, p. 4-2 (hereafter referred to as "FM 101-5").

2. "FM 21-40," p. 6-4.

CHAPTER 5

FACILITIES DAMAGE

Blast and fire damage facilities to varying degrees.[1,2] One particularly vulnerable target within the treatment facility is the family of electromechanical instruments used to support modern day healthcare. If they survive blast and fire they remain highly susceptible to damage from Electromagnetic Pulse (EMP) and Transient Radiation Effects on Electronics (TREE).[3] Semi-conductors and other solid state electronic components are highly sensitive to this type of nuclear radiation. There is now strong evidence that electromagnetic pulses cause both transient and possibly permanent defects in such materials.[4] To the degree that we approach full automation in the clinical laboratory of the treatment facility we may well find ourselves painted into a corner. If this is not worrisome enough reflect for a moment on the damage potential of EMP and TREE to unprotected and unexposed x-ray film.

ENDNOTES

1. "DA PAM 5Ø-3," pp. 154-275.

2. *Ibid*., pp. 276-33[illegible].

3. "RB 1ØØ-34," p. 2-5.

4. Stephen A. Oliva, LaWayne R. Strongberg, "Electronic Equipment: Can It Survive in the Nuclear Magnetic Environment?" *Military Medicine*, January 1979, pp. 28-31.

CHAPTER 6

CHEMICAL OPERATIONS COMPLICATIONS

Thus far I have not added chemical or biologic threats to the equation of medical operations in the nuclear environment. I frankly shudder to do so, as the complexity of surviving and conducting medical support under chemical/biologic warfare makes the nuclear problem appear like child's play. It is my candid opinion that despite reams of written material on chemical and biologic defense we are at the present time almost totally unprepared to conduct medical support under such conditions.

The basic issue is the catastrophic sanitation problem posed by the use of chemicals. Almost everything will be contaminated. The contaminated patient poses a threat to both the staff who must handle him, the environment he must be placed in as well as to patients already in the treatment system.

The mechanics of decontamination are very adequately discussed in "TM 3-220."[1] However, once decontamination is completed a very serious problem still remains. What happens to the contaminated material? The treatment facility will be faced with an ever growing pile of dangerous clothing, personal effects, work materials, run-off water and the like. Until the materials are burned, buried or neutralized in some fashion the casualty producing threat remains just as menacing as before the

process was started.

Consider the problem posed when a chemically contaminated patient arrives at a treatment facility with a critical wound. Which problem is addressed first? If the contamination were radioactive the immediate threat of the wound far outweighs a few more minutes of low level radiation. With chemical contamination plus a serious wound our treatment choices are not so generous. Complicating the decision process is the fact that there is no chemical geiger counter to pinpoint the degree and location of the contamination. The fact is that the presence of chemical contamination almost assures an unhappy outcome. However, as a rule of thumb, it is best to follow the dictum, "better blistered and living than decontaminated and dead."[2]

The scenario above does not address another basic problem. The use of Mission Oriented Protective Posture (MOPP) clothing may protect life but in no way will it allow a clinician to render medical care.

ENDNOTES

1. "TM 3-220"

2. "RB 100-34," p. 3-8.

CHAPTER 7

OPERATIONS

Medical operations on a nuclear battlefield demonstrate two areas of unique concern: fallout and the handling of radiologically contaminated patients.[1]

Fallout and Medical Operations

Ionizing radiation produced within one minute of detonation consists primarily of gamma and neutron radiation and is termed "prompt radiation."[2] "Residual radiation" is that which exists beyond the first minute after detonation. It consists primarily of alpha and beta particles as well as a larger number of radio isotopes "fission products" that are not highly penetrating.[3] Protection from prompt effects has to be made in advance. Protection from residual effects is quite another story.

As a hazard fallout endures for hours to weeks, following detonation. There is time for action, and that action may result in the difference between survival, uninjured, and death secondary to radiation.

On the battlefield the decision as to what precise action will be taken will be made by a Commander. Ideally, he will be assisted by target analysts and information developed by NBC Defense Teams. The physician/soldier should be knowledgable so as to assist in the decision

making process should he be asked. Specifically he should. . . "have general knowledge encompassing the nature of the hazard, dynamics of fallout pattern development, the significance of radar instrument readings, and the effects of radiation on personnel."[4]

Once alerted to the presence of fallout a Commander has only two basic courses of action: evacuate the area or remain in place. Assuming the authority to evacuate is forthcoming from higher headquarters the next decision to be addressed must be when to evacuate. Again there are only two choices: before or after fallout. To evacuate during fallout would only subject personnel to fallout radiation at its highest intensity.

The option to evacuate prior to arrival of fallout will probably not be feasible for medical units. I base this conclusion on the following facts: tactical elements may be forced to remain in the area simply because of mission requirements; terrain and or geographical situations may make evacuation impossible; helicopter evacuation will probably be untenable and ground transportation assets unavailable.

Fallout Protection

Medical units required to remain in areas of high radiation dose rates can survive and continue their patient care activities if adequate shelter is available to shield against radiation. Many materials available on the battlefield afford substantial shielding (Table 7-1).[5]

TABLE 7-1

SHIELDING PROPERTIES OF COMMON MATERIALS
FROM FALLOUT GAMMA RADIATION

Material	Half-value layer thickness (cm)*
Steel	2
Concrete	6
Earth	8
Water	12
Wood	22

*Thickness required to reduce the incident dose or core rate by one half.

Earth is the most readily available material and, excepting constructed buildings, provides the most feasible military fallout shelter for field use. Tunnels, caves, ditches and ravines make good natural shelters. We cannot afford the time or cost to build complex underground structures. Frequent movement and short term occupancy of sites by medical units preclude elaborate construction. This does not mean that protection must necessarily be sacrificed but comfort often must be. Other field expedient shelters could be "dozer trenches," dug in mobile hospital tents, vehicles, earth shelters or sand bagged existing facilities (3 bags in width and to a height of six feet).

If a policy is adopted of locating medical units in buildings, near burned out basements, or other structures that will serve as shelters most of the fallout shelter problem will be eliminated.

Medical units should seek shelter facilities prior to the time the dose rate is five rads/hour.[8] The determination as to when to leave is less specific and more a matter of judgment taking into consideration

such variables as dose rate outside of shelter and the purpose of leaving. Assuming a single detonation, continuous occupation of a shelter for more than seventy-two hours would almost never be necessary.

Radiologically Contaminated Patient Care

The handling of radiologically contaminated patients is the second unique problem peculiar to medical operations in a nuclear environment.

During fallout insufficiently protected personnel will become contaminated. This is distinct from being a radiation casualty. If these personnel are not wounded or sick they will be decontaminated at unit level. If sick or wounded, hospitalization becomes more complicated since contamination can result in both patient and attending medical personnel becoming radiation casualties.

There are three distinct hazards associated with the handling of contaminated patients: the whole body gamma hazard, the internal hazard from inhalation and ingestion of contaminated material and the beta contact hazard.[9] The hazards are not of equal importance.

Potentially, the whole body gamma hazard is the most important. In actuality it is considerably reduced by the time a patient reaches the hospital through the mechanism of "shake off" and radiological decay.

"Shake off" refers to the loss of radioactive dust from the patient's outer body surfaces as he walks, is carried or is otherwise transported to the treatment facility. The dust simply drops off or is blown off his clothing or skin.[10]

All radioactivity decays. Fallout activity decays to ten percent of its base time value seven hours past detonation and to one percent at forty-nine hours.[11]

Beta emitting isotopes do not pose a real hazard unless a person is

directly contaminated by ingestion or inhalation of particles.[12] External contamination results in a moderate degree of skin damage somewhat analogous to a thermal burn. Beta contact exposure is more a nuisance than a hazard and is easily prevented.

Proper handling of contaminated patients first requires detection. The availability and expertise in the use of radiac instruments is therefore the key to safe management and the "razor's edge" missing in the management of chemically contaminated patients. A patient should be considered to be contaminated when any radiac reading is 5 mrad/hr above background, or when background is above 1 rad/hr.[13] In the latter event the entire facility should be considered as contaminated.

There are two keys to the handling of contaminated patients: they do not represent a lethal hazard to themselves or to others and their practical decontamination is easily accomplished.

Simply removing clothing and footgear provides 90-95% decontamination.[14] Washing the casualty's hands and face provides 98%. An additional shampoo will provide 99% decontamination. These simple measures may not eliminate the possibility of single "hot" particles remaining in skinfolds but further measures are inappropriate in comparison to the magnitude of the hazard involved.

The receipt of contaminated casualties by a medical facility need not require the declaration of any alert or special condition throughout the facility. Standardized procedures for handling contaminated patients should be preplanned, practiced and include provision for:

(1) Detection of contaminated patients prior to admission.

(2) Notification of treatment personnel of the necessity to wear gloves.

(3) Decontamination (clothes and footgear) prior to admission.

(4) Indication of contamination on the records of those patients not completely decontaminated before admission.

(5) Follow-up monitoring and decontamination of those patients in (4).

(6) Disposition of contaminated clothing and equipment.

ENDNOTES

1. *Emergency War Surgery*, p. 72.

2. *Ibid*., p. 70.

3. *Ibid*., p. 69.

4. Michael J. Aston, "The Atomic Bomb vs Survival," *The Military Surgeon*, April 1950, p. 273.

5. US Department of the Army, *Field Manual 8-9*, p. 7-8 (hereafter referred to as "FM 8-9").

6. *Ibid*., p. 7-9.

7. *Ibid*.

8. Michael J. Aston, p. 275.

9. "FM 8-9," p. 7-10.

10. *Ibid*.

11. *Emergency War Surgery*, p. 70.

12. *Ibid*., p. 73.

13. Charles F. Behrens, *Atomic Medicine*, pp. 219-245.

14. "FM 8-9," p. 7-11.

CHAPTER 8

INITIAL MANAGEMENT OF MASS CASUALTIES

The entire process of initial management of large numbers of patients must be within the context of the total military effort to bring order out of chaos and restore the combat power of effective forces. Rescue operations, damage control and medical operations are complementary and should be closely coordinated and communicated. Medical operations even if augmented will require assistance from almost every logistical and administrative element in the affected command. Air evacuation will probably not be feasible nor possible. Medical personnel will provide sorting stations around the periphery of the disaster area. The basic principles of triage and patient classification must be thoroughly understood by all medical personnel. Transportation of casualties from sorting stations to treatment facilities will be the responsibility of medical personnel but transportation assets must be augmented.

The patients themselves are important players in the medical care effort. They must be trained to apply basic first aid to themselves and others. They must also be trained and held responsible for contamination of themselves and their equipment as soon as possible.

The basic principles of the management of mass casualties within treatment facilities remain unchanged. Army Medical Department personnel

will not reorganize or change relationships in the face of a workload surge. Personnel must function in what they are trained to do, but they intensify their effort. The critical role of the triage/classification officer should be assumed by the most experienced clinician available. The NATO HANDBOOK - EMERGENCY WAR SURGERY provides experienced and excellent guidance for this most important task.

CHAPTER 9

CONCLUSIONS

The basic objective of this research was personal education derived from disparate sources available to me at the US Army War College. I have elucidated the major problems associated with the conduct of medical operations in a nuclear environment and discussed possible solutions. It is both inappropriate and irresponsible to suggest that there are "cook book" solutions to the problems facing the physician in a nuclear scenario.

The injuries precipitated by nuclear detonation are essentially related to the physical effects characteristics of the weapons which in turn depend upon many variables. The ultimate success of medical operations will also depend on many variables not the least of which is the number and yield of the weapons employed against friendly forces. If that number is large it is highly probable that entire medical units will be lost or will become incapable of functioning because of large scale losses of personnel and equipment. Under such circumstances dispersion will be of minimal benefit and whole unit replacement must be considered. Where these units would come from would depend on availability and the mobilization plans both military and civilian, of the individual country.

The combined use of nuclear and chemical weapons presents an

incredible challenge to the health care community. At this time the literature presents few answers to this enigmatic problem.

Nuclear fallout is also a problem but fortunately one that with additional understanding, training, and the application of basic principles and readily available resources can be appropriately addressed.

The management of mass casualties, the disparity situation, both in the field and at rear area treatment facilities is going to be perhaps impossible at worst and difficult at best. It will demand that through rescue, evacuation and treatment every available resource must be optimized.

Patient triage and classification will remain the key to the management of patients. It will tax the skill and judgment of the medical officer.

The mass destruction capability of nuclear weapons not only can significantly alter the battlefield but can destroy humanity as we know it. These effects are far ranging and must be clearly understood by troop leaders and physicians. Many of the lessons of the past, all learned by war experience, ordinarily lie fallow between conflicts. They need to be relearned by hard experience and practiced through training. It is only through this understanding and training that the Army will be able to survive, fight and win the next major confrontation.

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